JUST ADOPTED BY THE SCHOOL BOARD FOR LONDON.
DAWSON'S ESSAYS, ESSAY-WRITING, AND PARAPHRASING.
Second Edition. Crown 8vo., extra cloth. Price 1s. 6d.

THE PRACTICAL TEACHER

A WEEKLY JOURNAL FOR MASTERS MISTRESSES AND STUDENTS

VOL. XI. NO. 12. SATURDAY, APRIL 4, 1891. PRICE 1D.

ADOPTED BY THE LONDON SCHOOL BOARD.

DR. BEACH'S

TEST CARDS

Seven Packets for Standards 2 to 7, and LONG TOTS,

PRICE 1/- PER PACKET.

The Teachers' Aid says:—'They stand First in the Market.'

LONDON:

JOSEPH HUGHES & CO., PILGRIM STREET, LUDGATE HILL, E.C.,

And all Booksellers.

CONCERT ACTION SONGS.

The British Flag .....Percy Jackman.
Grandmother's Dream .....F. L. Bristow.
Nelly's Dolly .....A. Watson.
Castles on the Sand .....Percy Jackman.
Merry Drummers.....Percy Jackman.

Price ONE SHILLING each, post free.

LONDON: J. CURWEN & SONS, 8 & 9, WARWICK LANE, E.C.

HUGHES'S

EXAMINATION COPY-BOOKS.

10 Books, 2d. each.

LONDON: JOSEPH HUGHES & CO., PILGRIM ST., LUDGATE HILL, E.C.

CERTIFICATE EXAM.

(1st or 2nd Year.)

SCHOLARSHIP EXAM.

HIGHLY SUCCESSFUL COACHING BY CORRESPONDENCE.

No fees unless successful first time. Backward students *made* to pass. Exceptionally low terms. Addressed envelope for particulars, list of successes, &c., GEORGE HENRY SPARROW, Forest Gate, London, E.

N.B.—Teachers who intend taking Papers are invited to communicate at an early date with Mr. Sparrow. The work for these Exams. having been the speciality for the past eight years, with increasing success each year, there is little fear of failure now. Dull students are got through safely, and bright ones pushed into First Division.

The increasing demands of each year's Exam. should warn candidates to engage a Coach, making a *speciality* of his or her requirements.

☛ SEE ALSO PAGE 191.

NEW DICTATION TESTS.

SELECTED EXERCISES IN DICTATION FOR STANDARDS V., VI. AND VII.

(The appended selections are from the *Times*.)

N.B.—In our next issue will be found a complete set of Arithmetic Tests for Standard VI. (Boys).

AT every point, reaching from Dover to Devon, trains were snowed up; passengers nearly frozen and starved to death during a captivity of many hours; and in the open country there have been accidents to mail carts and a sudden and hapless end to many a lonely pedestrian. The miserable incidents of the blocking of trains in snow-drifts, such as have hardly happened in this country since the great storm of January, 1881, or at least since the almost equally fierce storm of four or five years later, were repeated on Monday night in many directions.

***

AT length it was decided to anchor until a lull in the storm should reveal the land, if only for a little while. The cable was fastened and the anchor rattled out soon after four o'clock. The whistle was sounded to give notice of her whereabouts, but the signal was unheard above the storm. A gun far out at sea, announcing a ship in distress, was heard and mistaken by the folk on shore for a signal from the Monarch, but she never fired a gun. The snow cleared about five o'clock, and it was then discovered that she was lying off St. Margaret's Bay, about a mile from the shore, and eastward of the cable hut.

***

NO cabs or omnibuses at work for many hours, the streets first deep in muddy snow and then a pool of slush, which no man seemed even to wish to remove. Again the vestries were taken by surprise, and except here and there, where an exceptionally active surveyor happened to be in command, only the most miserably inadequate means were employed to clear the streets—an easy task, for the snow did not freeze—and to make them passable for the unhappy horses. But outside, in the country to the south-east and south-west, the difficulties were more formidable.

***

IT ought not, however, to be impossible to show the working men that a well-paid secretary, who forces them to provide him with funds and then squanders them in an impossible attempt to corner the market, has forfeited every claim to confidence. Before abandoning a union which has extorted heavy subscriptions and given nothing in return except some foolish speeches, it would be wise on the part of the deluded members to depose the wordy personage who has so mismanaged their affairs.

***

SUCH is a sample of the tragedies that are for ever happening in the obscure lives of the 'toilers of the sea.' A story which will appeal to a more general experience is that of the two powerful mail boats which achieved, in the face of enormous difficulties, the voyage between Calais and Dover. In the same neighbourhood, where the easterly gale blew its fiercest, the Monarch had to abandon the task of laying the telephone cable from the French to the English coast which her captain, somewhat rashly, attempted on the previous afternoon.

***

MILE after mile was traversed in this way, and all was going on well. As yet there were no signs of an approaching storm. A drizzling rain began to fall, and the breeze freshened, but it was not until towards three o'clock, when ten miles of cable had been paid out, and the Monarch was half seas over, that the gale came on, and the water became rough. The glass fell rapidly, and soon a blinding snow storm swept over the vessel. It was still possible to see for a considerable distance all round, and there was no danger of a collisoin, but the weather grew worse every moment. Mr. Lumsden had no intention of cutting the cable and buoying it.

***

THE captain knew how far he had gone on the course the Monarch was pursuing, and that he would soon fetch up off St. Margaret's Bay. The sea was lashed into fury by the violence of the gale, which increased to 9 deg., but the decks of the Monarch rode high, and there was little or no spray. The whirling flakes of snow were the enemy, and they drove on thicker and thicker, keener and keener, till the cheeks tingled and smarted as if they were being cut with crystals of ice. The lookout could only see a short distance ahead, and although the Monarch was nearing the land the white cliffs were invisible.

***

By far the greater part of the printing done in England has to do with books, periodicals, pamphlets, newspapers, and other issues which have nothing to do with America; and this, of course, will remain unaffected by the Act. For the rest, the conservatism of the book trade and of the reading public is great, and the cost of printing is not so heavy as to make it certain that, in order to save a portion of it, we shall have to put up with American type, spelling, and form of issue. The three-volume novel will die hard; and that, at least, must be produced and printed in this country.

***

CAPTAIN Thompson had made a good hit in spite of the blizzard. Having found his bearings, an attempt was made to lift the anchor and pay out all the cable, but the strong tide, aided by the furious wind, had driven the cable foul of the anchor, and after a fruitless attempt to clear, the anchor was slipped with 14 fathoms of chain. It was now a quarter past eight at night, and very dark, but the Monarch paid out the rest of the cable to avoid cutting it, and buoyed the end well off the shore to the east of St. Margaret's Bay, about 20 minutes past 9, then ran for the Downs, where she anchored soon after 10 o'clock.

***

SUFFERINGS by land have been small, however, in comparison with those that were experienced at sea. The tale of disaster is as yet incomplete, but it has many terrible incidents. There have been wrecks on the Goodwins; and few stories of the sea could be, on a limited scale, more shocking than that which is told of the seaman who drifted ashore in an open boat, at Clacton-on-Sea, and of his companions on the wrecked schooner. The lifeboat went swiftly and bravely to the rescue, and two men were saved; but when a rescuer climbed the mast to cut loose a sailor who was lashed to it he found him frozen to death.

***

FORTUNATELY for Her Royal Highness, she herself and the majority of the passengers, seeing that the gale was increasing to a hurricane, gave up their journey and went to the hotel. The boat started at about eight o'clock in the evening. The sea was awful; the snow was blinding; and the waves swept the decks at every moment. By half-past ten the neighbourhood of Cape Grisnez appeared to have been reached; but for many hours later, in fact till daybreak, it was impossible for the captain to make for the harbour, or in fact to do anything but anchor, and to let the waves do their worst.

A Course of Object-Lessons and Elementary Science.

(Adapted to the Syllabus of the New Code and of the London School Board.)

BY RICHARD BALCHIN,

Head Master under the School Board for London.

In this article will be given the remaining lesson in the Syllabus for Standard II.

The Air we Breathe.

23. Have ready on the table a terrestrial globe, a stoppered gas jar, candle, bottle of lime-water, taper, and, if possible, about a dozen sheets of wadding or of wool. Talk about the air in the room, and the fresh air outside; how we know there *is* such a thing as air. Whatever part of the world we live in, the same air is found. Hold up the globe and talk about the air surrounding our earth. Move the globe about, and so illustrate the fact that as our earth moves it carries its ocean of air with it as it does its oceans of water. This air has weight. A bottle quite empty of air would weigh less than one full. The air extends upwards to a great height, but we could not live at a height of eight or ten miles; air too thin. Air thicker near the earth; pressed closer together by the air above it. Illustrate this by piling up the sheets of wool. We breathe air, and, in breathing, effect a change in it. Show this by passing ordinary air through lime-water, and then breathing through lime water. Cover a burning candle with the stoppered jar until the candle goes out. Then into the jar introduce a lighted taper, which at once goes out, showing that combustion in air changes that air as well as breathing does. Do not of course say anything at present about the composition of air.

The Water of the Globe.

24. Have the globe, as in the last lesson. A picture of a river, or of any water-scene. A picture of springs, and of cloud-scenery. This subject may be divided into three parts, and furnish ample material for three simple lessons: first, the water *on* the earth; second, the water *under*, or in the earth; third, the water *above*, or around the earth. Hold up the globe and show the position of the great oceans of water upon the earth. Talk about it, and set the boys wondering why it does not all fall away. Show the picture of the water-scenery; talk about the flowing river, where it flows from, and where it flows to; lakes, canals, waterfalls. Do not in this lesson give any technical information about the source, mouth, &c., of a river; leave that for another lesson. Treat the matter quite in a general manner, simply excite a wish to know more. Now show a picture of a spring which continually bubbles up; where does this water come from? How did water get down into the earth? Where does it flow to? &c. In like manner show a picture of clouds. If the boys can see some clouds through the window, as they float along the sky, talk about them. What are they? If a person is up a high mountain in a cloud, what does it look like? How did this cloud get up there? Where did the water come from? When there is a shower many tons of water fall therefore those dark-looking clouds must contain many tons of water. No more water can ever fall as rain than has previously existed as clouds.

The concluding lessons for Standard II. will be geographical, viz.: (1) the land of the globe and its main features, (2) the chief parts of the waters of the globe.

The land of the Globe: Continents.

25. Have a map of the world; a globe; if possible a model of some part of the earth's surface, so constructed that water may be poured upon it to fill up the hollows. Talk about the configuration of the land in the neighbourhood of the school, or any country scene with which the boys are acquainted. In *this* part of the world I should have a chat about Peckham Rye with its ponds, or Dulwich Park with its ponds, its island etc. Suppose the latter pond emptied of water, then what *was* the island is seen to be simply the summit of the highest part of the land. Get the model and talk about the uneven surface, some parts high, some low; now pour in the water; the boys will see that the higher parts stand out of the water, above it, 'high and dry' as the boys will say. Now refer to the map. Show what represents water and what land. Suppose all the water were drained away from the globe, what sort of surface should we find? Tell the boys that the Moon is just such a globe. No water there, no clouds, no rain, a cold dead world. Set the boys wondering about this. Tell them there was a time when there was no water on the surface of our globe, it was too hot, it was a blazing star, only greatly-heated water-vapour all round it. Set the boys wondering about this. When water first began to collect upon the earth, where would it first settle? Refer to the model. The largest portions of the earth which rise from out the waters are called 'continents.' So lead on and name the five continents.

The land of the Globe: Mountains.

26. Have the model as before. A picture of a mountainous country, if possible 'the Bernese Oberland;' a picture of a volcano, and of any highland scenery of the immediate neighbourhood. Recapitulate and dwell upon the idea worked out in the last lesson, viz., that all the dry land of the globe, that is, all the continents, is simply land rising above the general surface of the water of the globe. Then lead on by the help of the model to the conception of a mountain or hill as being simply the topmost parts or peaks of this high land. Talk about any hill or mountain in the neighbourhood. Compare the beautiful scenery of some of our English Hills, such as the North Downs with their gradual smooth slopes, with the wild grandeur of such mountains as those in the picture of Alpine scenery. Such hills as the former are generally of chalk or clay, or loose sand, while the latter are of rough stone. The former beautifully wooded, the latter bleak and bare. Refer to some of the more important of the mountains of England and of Europe.

The Land of the Globe.

27 and 28. These lessons may be devoted to a simple explanation of the chief parts of land configuration, such as islands, peninsulas, capes, etc., for which no notes are necessary.

Parts of the Water of the Globe: Oceans.

29. Have ready the model as before, and a map of the world. Refer to the idea worked out in a previous lesson about the draining away of all the water of the globe and the appearance of the uneven surface left. Use the model to illustrate this. When the water comes on to the globe it will collect first in the greatest hollows. Let a boy come out and point out the great hollows or depressions in the model. Refer to the map. Talk about the Atlantic Ocean. Speak of the continents almost enclosing it. If all this ocean were drained off, what a great hollow or depression there would be between Europe and America. Yet this depression is not much greater, as compared with the size of the earth, than are the little uneven parts of the rind of an orange. Name the other great oceans and get the boys to point out their position upon the map.

Parts of the Water of the Globe.

30 to 32. In these lessons take up the other portions of water, treating inland seas and lakes as smaller depressions or hollows in the earth's surface filled up with water. Then pass on to springs, brooks, streams, rivers, and waterfalls. For these lessons no notes are necessary.

(To be continued.)

—o—

ANSWERS TO PUPIL TEACHERS' TEST EXAMINATION.

FIRST YEAR.

Arithmetic. (Boys.)

1. $9\frac{1}{2}$.
2. (*a*) 938,000; (*b*) 76,633·3; (*c*) ·02403.
3. ·111 +
4. $\frac{1}{4}$.
5. $\frac{1}{8}$.
6. £19 13s. $5\frac{1}{19}$d.

Arithmetic. (Girls.)

1. £5 4s. $0\frac{1}{4}$d.
2. 4s. $3\frac{3}{4}$ left.
3. (*a*) £11 3s. 4d.; (*b*) £12 2s. 6d.; (*c*) £7 19s. 6d.; (*d*) £2 7s. $0\frac{1}{4}$d.
4. — $29\frac{1}{4}$.
5. £35 1s. $6\frac{1}{19}$d.
6. 119.

SECOND YEAR.

Arithmetic. (Boys.)

1. 24 days.
2. $1\frac{1}{2}$ years.
3. £451 17s. 6d.
4. £8,050.
5. $4\frac{1}{2}$ %.
6. $91\frac{1}{3}$ %.

Arithmetic. (Girls.)

1. £$13\frac{1}{3}$.
2. £14 12s. 9d.
3. 83 9,298.
4. $\frac{3}{11}$.
5. (*a*) ·0,625; (*b*) ·056.
6. $949\frac{1}{2}$.

THIRD YEAR.

Arithmetic. (Boys.)

1. 0.
2. $1\frac{3}{4}$.
3. $2\frac{3}{4}$d.
4. £1,333$\frac{1}{3}$.
5. 107 yards.
6. $3\frac{3}{4}$ %.

Arithmetic. (Girls.)

1. 2.
2. £45 11s. $3\frac{3}{4}$d.
3.
4. 79,200.
5. (*a*) £15 1s. 3d.; (*b*) £10 0s. 10d.; (*c*) £8 0s. 8d.
6. 12 men.

FOURTH YEAR.

Arithmetic. (Boys.)

1. 69 tens.
2. £28 8s. 9d.
3. 612 shares.
4. 16·8 oranges.
5. 5s. $1\frac{1}{4}$d.

Arithmetic. (Girls.)

1. The Simple Interest is itself $\frac{1}{15}$ of the Principal.
2. £$93\frac{1}{3}$
3. £8·050.
4. £177 18s. $11\frac{7}{19}$d.
5. 10d.

Algebra.

THIRD YEAR.

1. Prove that $a^m \times a^n = a^{m+n}$

$a^m = a \times a \times a \times a$ ..... m times

$a^n = a \times a \times a \times a$ ..... n times

$\therefore a^m \times a^n = (a \times a \times a$.....$m$ times$) \times (a \times a \times a$.....$n$ times$) =$
$(a \times a \times a$.....$m + n$ times$) =$
a^{m+n}.

Length of room $= p$ feet $= \frac{p}{3}$ yards

Breadth $\quad = q$ yards

$\therefore$ Area $\quad = \left(\frac{p}{3} \times q\right)$ sq. yds. $= \frac{pq}{3}$ sq. yds.

Cost of carpeting at r shillings per sq. yd $= \frac{pq}{3} \times r$ shillings

Ans. $\frac{1}{3}pqr$ shillings.

2. (*a*)

$$\frac{x+y}{2(x-y)} - \frac{x-y}{2(x+y)} - \frac{2y^2}{x^2-y^2} =$$

$$\frac{(x+y)(x+y) - (x-y)(x-y) - 4y^2}{2(x^2-y^2)} =$$

$$\frac{x^2+2xy+y^2 - x^2+2xy - y^2 - 4y^2}{2(x^2-y^2)} =$$

$$\frac{4xy-4y^2}{2(x^2-y^2)} = \frac{4y(x-y)}{2(x^2-y^2)} = \frac{2y}{x+y}$$

Ans. $\frac{2y}{x+y}$

(*b*)

$$\frac{x+3}{x^2-7x+12} - \frac{x+4}{x^2-6x+8} + \frac{x+4}{x^2-5x+6} =$$

$$\frac{x+3}{(x-3)(x-4)} - \frac{x+4}{(x-2)(x-4)} + \frac{x+4}{(x-2)(x-3)} =$$

$$\frac{(x-2)(x+3) - (x-3)(x+4) + (x+4)(x-4)}{(x-2)(x-3)(x-4)} =$$

$$\frac{x^2+x-6 - x^2-x+12 + x^2-16}{(x-2)(x-3)(x-4)} =$$

$$\frac{x^2-10}{(x-2)(x-3)(x-4)} = \frac{x^2-10}{x^3-9x^2+26x-24}$$

Ans. $\frac{x^2-10}{x^3-9x^2+26x-24}$

3.

$$6x^5 - 4x^4 - 11x^3 - 3x^2 - 3x - 1$$

$$4x^4+2x^3-18x^2+3x-5\overline{)12x^5 - 8x^4 - 22x^3 - 6x^2 - 6x - 2}\ (3x$$

$$\underline{12x^5 + 6x^4 - 54x^3 + 9x^2 - 15x}$$

$$-14x^4 + 32x^3 - 15x^2 + 9x - 2$$

$$\underline{-28x^4 + 64x^3 - 30x^2 + 18x - 4}\ (-7$$

$$\underline{-28x^4 - 14x^3 + 126x^2 - 21x + 35}$$

$$39\overline{)78x^3 - 156x^2 + 39x - 39}$$

$$2x^3 - 4x^2 + x - 1$$

$$2x^3 - 4x^2 + x - 1\overline{)4x^4 + 2x^3 - 18x^2 + 3x - 5}\ (2x + 5$$

$$\underline{4x^4 - 8x^3 + 2x^3 - 2x}$$

$$10x^3 - 20x^2 + 5x - 5$$

$$\underline{10x^3 - 20x^2 + 5x - 5}$$

G.C.M. required $= 2x^3 - 4x^2 + x - 1$.

4. $x^2(9 + 4y^2 + 12y) - 24xy + 16y^2(1 - x) =$

$$9x^2 + 4x^2y^2 + 12x^2y - 24xy + 16y^2 - 16xy^2$$

$$9x^2 - 24xy + 16y^2 + 4x^2y^2 + 12x^2y - 16xy^2 \quad (3x - 4y + 2xy$$

$9x^2$

$6x-4y\overline{|}\ -24xy + 16y^2$

$\underline{\quad -24xy + 16y^2}$

$6x-8y+2xy\ \overline{|}\ 12x^2y - 16xy^2 + 4x^2y^2$

$\underline{\qquad\qquad 12x^2y - 16xy^2 + 4x^2y^2}$

Ans. $3x - 4y + 2xy$.

5. Let $2x$ = price of butter per lb. (in shillings).

x = price of eggs per doz. ,,

$12x$ = ,, 12 doz. eggs.

$40x$ = ,, 20 lbs. butter.

$12x + 40x = 26$

$52x = 26$

$x = \frac{1}{2}$s. = 6 pence.

Ans. 6 pence.

FOURTH YEAR.

Algebra.

1.

$$x^3-3x^2-13x+15\overline{)x^3+9x^2+11x-21}\ (1$$

$$\underline{x^3-3x^2-13x+15}$$

$$12\overline{)12x^2+24x-36}$$

$$x^2+2x-3\overline{)x^3-3x^2-13x+15}\ (x-5$$

$$\underline{x^3+2x^2-3x}$$

$$-5x^2-10x+15$$

$$\underline{-5x^2+10x+15}$$

G.C.M. $= x^2 + 2x - 3$.

2. (a) $\dfrac{x+3}{x^2-7x+10} + \dfrac{x+2}{x^2-8x+15} + \dfrac{x+5}{x^2-5x+6} =$

$$\frac{x+3}{(x-2)(x-5)} + \frac{x+2}{(x-3)(x-5)} + \frac{x+5}{(x-2)(x-3)} =$$

$$\frac{(x+3)(x-3) + (x+2)(x-2) + (x+5)(x-5)}{(x-2)(x-3)(x-5)} =$$

$$\frac{(x^2-9) + (x^2-4) + (x^2-25)}{(x-2)(x-3)(x-5)} =$$

$$\frac{3x^2-38}{(x-2)(x-3)(x-5)} = \frac{3x^2-38}{x^3-10x^2+31x-30}$$

Ans. $\dfrac{3x^2-38}{x^3-10x^2+31x-30}$

(b)

$$\frac{x^2+y^2}{x^2-y^2} = \frac{\left(\frac{a+b}{a-b}\right)^2 + \left(\frac{a-b}{a+b}\right)^2}{\left(\frac{a+b}{a-b}\right)^2 - \left(\frac{a-b}{a+b}\right)^2} = \frac{\frac{(a+b)^2}{(a-b)^2} + \frac{(a-b)^2}{(a+b)^2}}{\frac{(a+b)^2}{(a-b)^2} - \frac{(a-b)^2}{(a+b)^2}}$$

$$= \frac{\frac{(a+b)^4 + (a-b)^4}{(a^2-b^2)^2}}{\frac{(a+b)^4 - (a-b)^4}{(a^2-b^2)^2}} = \frac{(a+b)^4 + (a-b)^4}{(a+b)^4 - (a-b)^4} =$$

$$\frac{2a^4 + 12a^2b^2 + 2b^4}{8a^3b + 8ab^3} = \frac{a^4 + 6a^2b^2 + b^4}{4ab(a^2+b^2)}$$

Ans. $\dfrac{a^4 + 6a^2b^2 + b^4}{4ab(a^2+b^2)}$.

3. Let x = larger digit

and y = smaller digit

Larger number $= 10x + y$

Smaller number $= 10y + x$

$(10x + y) + (10y + x) = 176$

or $11x + 11y = 176$

or $x + y = 16$ ..... (I.)

$(10x + y) - (10y + x) = 18$

or $9x - 9y = 18$

or $x - y = 2$ ..... (II.)

Add I. and II. $2x = 18$, $x = 9$

Subtract II. from I. $2y = 14$, $y = 7$

∴ Numbers required are 97 and 79.

4. (a) $\dfrac{x+3y}{4} + \dfrac{3x+y}{12} = 11$

$3x + 9y + 3x + y = 132$

or $6x + 10y = 132$

or $3x + 5y = 66$ ..... (I.)

$x + y = 8(y - x)$

or $x + y = 8y - 8x$

or $9x - 7y = 0$ ..... (II.)

Multiply I. by 3. $9x + 15y = 198$

$9x - 7y = 0$

$22y = 198$

$y = 9$

Substitute for y in II. $9x = 63$, $x = 7$.

Ans. $x = 7$

$y = 9$

(b) If $x = 3$, $x - 3 = 0$;

if $x = -3$, $x + 3 = 0$.

Whichever of these is taken, the product

$(x - 3)(x + 3) = 0$,

that is $x^2 - 9 = 0$, or $x^2 = 9$.

This therefore is the equation required.

If $x^2 + ax + 576$ is a perfect square, 576 must be the square of a certain number of which the coefficient of x in the middle term is double, since the expression is of the type $x^2 + 2nx + n^2$.

Now $\sqrt{576} = 24$,

∴ $a = 48$.

(To be continued.)

An Elementary Course in the Use of Wood Working Tools.

BY FRED. WILKINSON, F.G.S.,

Science Teacher under the Bolton School Board.

EXERCISE XXX.: A PICTURE FRAME.—In Fig. 135 we see the simple frame which forms the next exercise.

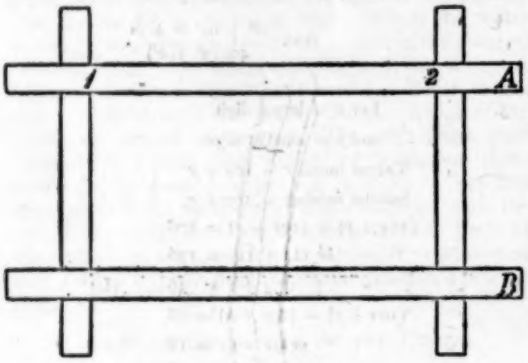


Fig 135.

The difficulty presented here consists in being able to perform the halving exercise neatly.

We require four pieces of oak 1 inch wide and ½ in. thick. Two should be 1 foot long and the longer two 1½ feet long.

Having planed them up to the required measurements we proceed to make the halvings.

Mark off from the ends of all four a line 3 inches distant from the end, and another at a distance of 1 in. from that. Fig. 136 shows piece A ready for sawing, and B is like it.

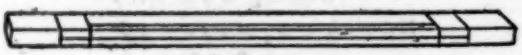


Fig. 136.

As the pieces A and B are ½ in thick we must gauge a line between the other two ¼ in. from the edge. Notice in pieces A and B that the lower halves will require removing, and in the pieces C. and D. the upper pieces will require to be removed. Careful marking and cutting will alone give four good joints. This being done we next proceed to put in a groove and to fit in a back. In piece A and B it will be necessary to remove a little wood to form a groove. Let Fig. 136 represent piece A with its under side upwards. Now run a gauge line ¼ in. as shown in fig inside the notches and on that edge which lies inside the frame.

Follow the ¼ in. gauge line along as shown, and remove the part shown in the figure. Now put the four pieces together again. It will seen how much of C. and D. are to be removed. When this is done either fit in a cardboard back or thin wood back. The frame is now glued, and when varnished is ready for use.

Exercise XXXI.

An open mortise and tenon joint.—As we have already described this joint, we do no more now than give two drawings of this joint which is called the open mortise and tenon joint.

Fig 137.

If we look at fig 137 we see the two pieces joined. In piece A we have the open mortise open so as to allow the face of piece B to come flush with the end of A. In fig 138 the two are separated.

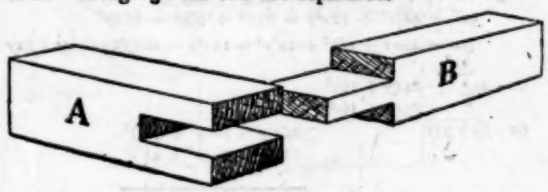


Fig. 138.

Exercise XXXII.

A closed mortise and tenon.—We now proceed to make what is known as the closed mortise and tenon. In fig. 139 we have an example of this joint. This

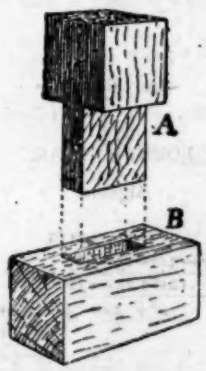


Fig. 139.

form of joint is one of the most frequently used in all wood work. We can scarcely find any article used in the home but which contains this particular joint. We have two pieces A and B, A containing the tenon and B containing the mortise.

Get two blocks 3 in. square and 6 in. long. Call one A and the other B. On A we are required to cut the tenon and in B to cut the mortise. On A gauge a line all round at 3 in. from the end and set gauge now to 1 in., and gauge over end and down two sides, marking out the tenon. Remove matter by sawing.

To remove the wood to form the mortise we proceed as follows:—Lay the piece A on B, and mark off two lines running round on all four sides. The piece A must be placed on the centre of B,

As B is 3 in. wide, on upper and lower sides gauge lines 1 in. from the face edge. This will guide the pupil and show what matter must be removed by the chisel. This we do by firmer chisel and mallet cutting half way through and then working on the reverse side in the same way. When properly executed all the surfaces of A and B should be flush. In fig. 140 we see the finished joint.

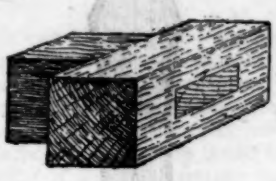


Fig. 140.

Exercise XXXIII.

A Clothes Horse.—Prior to the making of this object one word must be said about wedged mortise and tenons. If we glance at figs. 141 and 142 we see

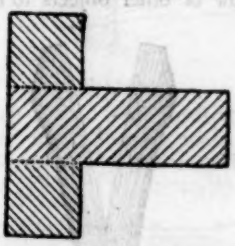


Fig. 141.

the ordinary mortise and tenon and the wedged mortise and tenon joints in section.

The difference lies in this. When the former joint has been made, with the chisel take out a piece from the side of the mortise as shown in fig. 142. Now

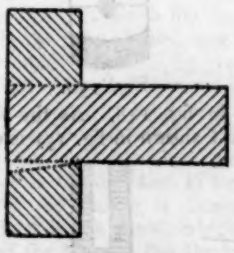


Fig. 142.

make a wedge which will fit the wedge-like cavity just made with the chisel. When everything is ready for jointing, the tenon is placed in and glued, and then the wedge is driven in with glue on it, and thus a far tighter joint is the result. In the construction of nearly all doors, window frames, and beams, this joint may be seen. We now go on to make the towel or clothes horse so useful in the home. For this purpose we require four rods of deal 3½ feet long, 1 in. thick, and 1½ in. broad, when planed up. In addition to these we require 6 pieces of deal also 2 ft. 3 in. long, ½ in. thick, and 1⅝ in. wide.

In fig. 143 we have a section of the object we are

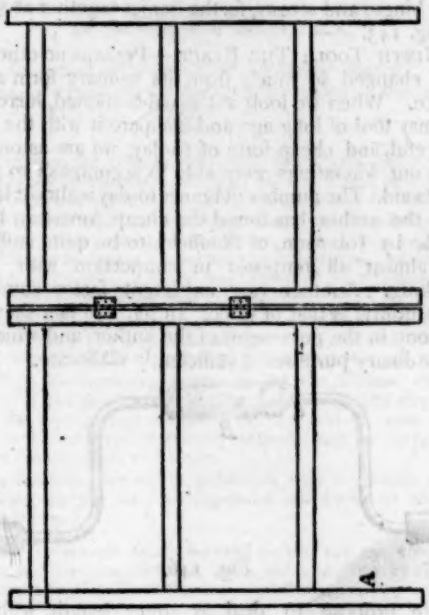


Fig 143.

about to make. We shall be required to make no less than twelve joints, and all these will be wedged mortise and tenon joints.

We shall describe in detail the construction of one and leave the pupil to finish the rest of them. Let us mark one of the pieces A. Gauge this so as to leave ¼ in. in the middle. Now if it be 1½ in. thick we must set our gauge to ⅜ in. This will leave ¼ in. which is to be the thickness of the tenon. Let fig. 144 be the rod we are working on with the gauge lines marked.

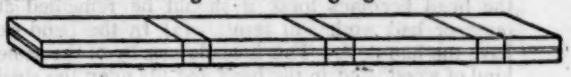


Fig. 144.

At a distance of 2 in. from end gauge over two lines 1⅝ in. apart as shown and two others at a distance of 12 in. from the first two, and two others at a distance of 2 feet from the first. Carry these lines over on all four sides. It will be now seen where the mortises are to be made. Mark the other three pieces similarly, and now proceed to make the tenons on the six remaining pieces.

Let fig. 145 represent one of the six cross pieces.

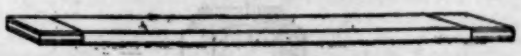


Fig. 145.

We require it to be marked 1½ in. from the end on all four sides and at each end. As the mortise is ⅜ in. only, we must have our tenon the same. The piece we are now working on is only ½ in. thick, so that we set the gauge to ⅛ in. and gauge as shown in fig. 145. Now saw and leave the tenon at each end. Work all the six pieces in this way and fix the two frames together. Now remove the wedge-like piece referred to from the mortises and make a sufficient

number of wedges. Glue together and, by means of two hinges and screws, fix the frames together as shown in fig. 143.

NINTH TOOL: THE BRACE.—Perhaps no other tool has changed so much from its primary form as the brace. When we look at the old-fashioned, heavy and clumsy tool of long ago and compare it with the light, graceful, and cheap form of to-day, we are astonished that our forefathers were able to accomplish so much by its aid. The number of braces to-day is almost legion, but the author has found the cheap American brace, made by Ibbotson, of Sheffield, to be quite sufficient for almost all purposes in connection with wood working. Another very important factor combined with utility, is that of price. In fig. 146 is a sketch of the one in the possession of the author, and which for all ordinary purposes is sufficiently elaborate.

Fig. 146.

We propose to deal at some length with the technical points in connection with this tool. To describe its construction and to show how it may have other tools fitted into it.

The parts are as follows:—(1) The head *c*. This is usually made of beech or ebony or rosewood. Some are made of iron, but these are unwieldly. The bent steel rod is fitted into a socket and kept into position by a cap which is screwed to the head. This part of the brace should be kept well oiled. It will be apparent that true work cannot be obtained if motion is allowed except in a horizontal plane. When the head becomes loose it should be remedied at once or bad work will result. (2) In the bend we have the handle *b*. This is made usually of the same kind of wood used in the head and fits upon the steel rod like a bobbin. It is kept in position by means of two steel caps. The handle is only free to move round the rod and not up and down it. A little oil will cause this part of the brace to work properly when it becomes stiff. (3) At A we have what is technically known as the sleeve. We see the reason of this at once. It covers something inside and because of this arm being covered as well as D the jaws, it receives the popular name of 'sleeve.'

In fig. 147 we show an enlarged drawing of the sleeve as it appears when off the arm.

Fig. 147.

4. At D we have the jaws. These are so called because as the sleeve is unscrewed these become loose and open very much in the same way as the jaws of a boy. In fig. 148 we have the jaws separated from the brace and closed. These work upon a pivot

Fig. 148.

shown in the drawing near the bottom. They are free to move outwards until stopped by the two faces shown, and they are also free to move round on the pivot. Their essential motion is outwards and inwards to allow of other objects to be placed within their jaws.

Fig. 149.

In fig. 149 we see these jaws open to receive the bits of which we shall presently speak. Fig. 150 shows us the end when viewed in the direction of the

Fig. 150.

arrow shown in fig. 148. As the sleeve leaves the brace the form shown in fig. 151 is exposed to view.

Fig. 151.

This is a screw of the form of the letter U and now we see why it is of this particular shape. The opening is made specially to receive the jaws, and this is the only function it has to perform. On this screw, however, runs the sleeve by which we open or shut the jaws at will. To fix the tool in the brace will be our business next after we have described the tools which fit into the brace.

TENTH TOOL: THE BITS.—In ordinary use two kinds find their way into the ordinary workshop. These are Centre and Shell Bits. In fig. 152 we have

Fig. 152.

one of the former kind shown. It consists of four very important parts, viz.: (1) The spur. It is by means of this part of the bit that the work is centred. By this we mean that whenever the point of the spur is placed upon the work, then that point marks the centre of the hole which will be bored if we proceed with the work. If a section (transverse) be made of the spur it will be found to be triangular. (2) The nib or point of the bit. This is the worker of the bit. When we look at it sideways we find it is of the form shown in fig. 153, and thus we see that it is this part

Fig. 153.

of the tool which will do all the cutting across of the fibres. In other words the nib makes the work of the next part which we have to describe considerably easier. (3) The 'removing lip.' If reference

Fig. 154.

be made to fig. 154 we see the bit from another point of view, and here we find the lip projecting as shown. When the nib has successfully cut the fibres, the lip following removes the matter very easily, and the result is a circular hole. (4) Here we have the shank of the bit. It is this part which fits into a receptacle specially made in the jaws. It will now be understood why the square hole shown in fig. 150 is useful in gripping the shank when placed in the jaws.

To remove from or fix a bit in the brace.—Grasp the sleeve firmly in the left hand. Take the handle, see fig. 146, in the right hand and move the brace towards the body in the direction of the arrow shown in fig. 146. As the sleeve is loosened the jaws gradually disappear in the sleeve, which by the screws works its way off the brace. But the jaws open so as to admit the shank of the bit. When placed inside the bit may be made tight by screwing on the reverse way to that indicated by the arrow in fig. 146.

Shell bits are used for boring very small holes, and for this purpose are valuable. Fig. 155 shows us one.

Fig. 155.

They are so named because the end of the bit is made of steel in the form of a shell.

(To be continued.)

The 1891 Scholarship Examination.

BY DR. GEORGE BEACH, M.A.

Co-Author of 'A Manual of our Mother-Tongue,' Author of 'Elements of English,' 'Entertaining Readers.'

1. Between the present date and that of the Scholarship Examination (Wednesday, 8th July) about fourteen and a half weeks intervene, which we propose to apportion as follows:—

The present and the following weeks will be devoted to 'PRIVATE STUDY' in order that arrears of work may be wiped out, that any backward subject may be attended to, and that the *Science and Drawing Subjects* may receive more attention than usual, preparatory to the May examinations.

The end of this fortnight's *Private Study* will also find half of our Scholarship 'Articles' published and the complete Scholarship Course (with the exception of Music) gone through.

During the remaining twelve weeks the Course will be duplicated and amplified, and (the Science and Drawing time being set free) greater attention will be paid to some other subjects hitherto rather scantily noticed, such as Language, School-Management, and Music.

Ten Routines only will be published, with ten weekly sets of questions, leaving the final two-and-a-half weeks for the last furbishing-up.

2. In the present Article we shall occupy the space supplied by the non-insertion of the Routine and Questions by clearing off arrears owed to Correspondents and Pupils.

3. THE MONROE DOCTRINE.—James Monroe, fifth President of the United States, was elected to the supreme office in 1816, and in 1820 was re-elected with only one dissentient vote.

This great compliment he owed to his having procured the cession of Florida by Spain to the United States during his first term of administration, and to the settlement of the vexed question of the *extension of slavery* by the 'MISSOURI COMPROMISE,' latitude 36° 30' being fixed as the line above which this abominable institution was prohibited.

He gained great popularity during his official career by formally recognising as independent powers the emancipated Spanish and Portugese colonies of South America, and by the promulgation of what has received the name of 'THE MONROE DOCTRINE. This declares the policy of the United States to be—(1) Keeping themselves clear from the entanglements of European broils, (2) Not suffering the powers of the Old World to interfere with the internal affairs of the New World.

4. THE COMMERCIAL POLICY OF THE UNITED STATES is '*Protection of the extremest order.*' This has very recently been rigorously demonstrated by the passing of the McKinley Bill.

These columns are not the place wherein to discuss the entangled subjects of 'Free Trade,' Fair Trade, or Protection; but suffice it to say, that owing to its immense area and great diversity of climatic conditions and soil, the policy of '*Protection*' cannot possibly entail such disadvantages to the United States as it would do in the case of our own isles. If Great Britain and Ireland initiated a policy of '*Protection*' without including in its area the whole empire, the results would doubtless be immediately and gravely disastrous.

5. THE METRIC SYSTEM and its explanation are now being excellently explained *in this paper by Mr. Charles Bowden.* All his articles should be carefully studied, as the subject is almost certain to 'crop-up' at the Scholarship Examination. A capital little penny book, entitled '*The Metric System Made Easy,*' has just been issued by Mr. Hughes. It is compiled by that accurate and painstaking arithmetician *Mr. Joseph Wellman.*

6. *Two men, A and B, own adjoining farms of* 360 *and* 540 *acres respectively. They unite the farms and take a partner, C, who pays them* £2000 *on the understanding that a third share of the land shall in future belong to each. How is the* £2000 *to be divided between the original owners?*

One third of the united farms equals 300 acres and is bought by C for £2000, A and B each retaining 300 acres. Evidently therefore A gives up 60 acres and B yields 240 acres; A's share of the £2000 is therefore ¼ or £400, and B's share is £1600.

7. *Three bells, A, B, and C, toll at intervals of* 12, 15, *and* 28 *seconds respectively. A person at a distance from them can hear their sound only when two at least toll at the same time. If they began together, how many times will he hear their sound in seven minutes; (Omit the concluding toll as being outside the seven minutes.)*

The possible combinations are (1) A and B and C, (2) A and B, (3) A and C, (4) B and C. But one toll has to be subtracted from (A and B), (A and C), and (B and C), because, beginning together, it is reckoned in the tolling of (A and B and C).

(1) (A and B and C)	G.C.M. of 12, 15, 28 is 420 seconds,	∴ No. of tollings =	1
(2) (A and B)	,, ,, 12, 15	is 60	,,	∴ ,,	,, = (7−1) 6
(3) (A and C)	,, ,, 12, 28	is 84	,,	∴ ,,	,, = (5−1) 4
(4) (B and C)	,, ,, 15, 28	is 420	,,	∴ ,,	,, = (1−1) 0
				∴ Total No. of Tollings =	11

8. *In a mile race A can give B* 20 *yards, and B can give C* 88 *yards. How much can A give C in this race?*

B runs 1760 yards while C runs 1672 yards,

,, 1 ,, ,, $\frac{1672}{1760}$ yards,

,, 1740 ,, ,, $\frac{1672}{1760} \times 1740$ yards = 1653.

But A runs 1760 yards while B runs 1740 yards,

∴ A ,, ,, C ,, 1653 ,,

∴ A can give C 107 yards.

9. It should be noted that problems identical with the two last appear under disguised forms. Thus the bell problem may appear thus :—

Three parallel rows of posts are so placed that a man passing in front of them, in a line parallel with them, cannot discern them unless at least two are in the same straight line. If the distance between the posts in the first row is 12 *yards, in the second row* 15 *yards, and in the third row* 28 *yards, and the man so starts that the first posts and himself are all four in the same straight line, how many posts will he see in* $1\frac{1}{8}$ *furlongs?*

The race problem may be propounded as follows :—

In games at billiards 1760 *up, A can give C* 20 *points, and B can give C* 88 *points. If A give C* 108 *points, what will be the result, and by how many points (if any) will one of the players win?*

10. *The income tax was reduced from* $7\frac{1}{2}$*d. to* 6*d. in the pound; but a man's gross receipts were at the same time reduced by* $3\frac{1}{2}$ *per cent. Find by what percentage his net income is altered.*

The neatest and shortest way of solving this question is :—

$7\frac{1}{2}$d. in £ = $\frac{7\frac{1}{2}}{240} = \frac{3\frac{1}{2}}{100}$ or $3\frac{1}{2}$ per cent. So that had the tax been abolished, his net income would have been exactly the same. But he has to suffer a loss from Income Tax of 6d. in the £, or of $2\frac{1}{2}$ per cent. Ans.

11. *'Borrowing' in Subtraction.*— It is time that this unscientific term be completely discarded. Many candidates talk of borrowing from the top line and paying back to the bottom, and this whilst professing *to explain* the process of subtraction. This is 'robbing Peter to pay Paul,' and certainly conveys no idea to young children.

In this style of subtracting the principle utilised is briefly this—If there be two different numbers and to these numbers an equal amount be added, the difference between the two resulting numbers is equal to the difference between the two original numbers, *e.g.* (9—7) = (19—17). Take 107 from 305.

	H	T	U
305 add to each 110	3	10	15
107 or 10 tens and 10 units ...	2	1	7
198	1	9	8

12. EXPLANATION IS NOT PROOF.

Prove the rule for finding a Vulgar Fraction equivalent to ·34$\dot{5}$.

To work the sum, to explain in detail the actual steps taken, and to enunciate the rule does not answer the question. This is the way—

1000 times ·34$\dot{5}$ = 345·4$\dot{5}$

10 ,, = 3·4$\dot{5}$

∴ 990 ,, = 342

∴ ·34$\dot{5}$ = $\frac{342}{990} = \frac{38}{110} = \frac{19}{55}$. Ans.

13. *The accounts of a school showed a debt which was paid off by three managers—A, B, and C. A paid half the debt and £2 more, B paid half the remainder and £7 more, and C half of what then remained and £8, which just cleared off the debt. What did each pay?*

(*a*) It is evident that C paid £16. (*b*) Add to this £7, which gives £23 as half the remainder (or £46 as the whole remainder) after A had paid his quota. (*c*) Add to this £2, which gives £48 as half the debt, or £96 as the whole debt. *Therefore A paid £50, B paid £30, and C £16.*

BY ALGEBRA. Let £x = the debt.

Then A paid $\frac{x}{2} + 2 = \frac{x+4}{2}$, leaving as remainder $\frac{x-4}{2}$.

,, B paid $\frac{x-4}{4} + 7 = \frac{x+24}{4}$.

,, A and B paid $\frac{x+24}{4} + \frac{x+4}{2} = \frac{x+24}{4} + \frac{2x+8}{4}$

$= \frac{3x+32}{4}$ leaving as remainder $\frac{x-32}{4}$.

,, C pays all this, viz., $\frac{x-32}{4}$, half of which $\frac{x-32}{8} = 8$.

∴ $x - 32 = 64$; ∴ $x = 96$, etc.

14. *Make up a* SUBORDINATE SENTENCE *introduced by* 'BUT.'

This can be done in two ways—(*a*) by connecting two noun sentences by '*but*,' *e.g.*, 'I said, "he must go, *but* John must stay;"' (*b*) by using '*but*' idiomatically as a kind of negative relative, *e.g.*,

'There breathes not clansman of my line
But would have given his life for thine.'

15. *The Adjective* 'LIKE,' *and the Conjunction* 'THAN.'

(*a*) '*He is* LIKE HIM.' To understand this construction the reader must be familiar with the Adverbial nature of the Objective and Dative cases. This should be well studied, as '*catches*' are often set upon it. Here 'LIKE' is an Adjective used Predicatively qualifying '*he*,' and 'HIM' is Dative (Objective if you like) modifying '*like*.'

(*b*) 'THAN' never possesses a Prepositional force except in connection with such phrases as '*than whom none was braver*.' Elsewhere it is a Conjunction, frequently introducing an elliptical sentence, *e.g.*,

'*Louder* THAN *the bolts of heaven* [WERE LOUD]
Far flashed the red artillery.'

16. *His listless length at noontide* WOULD *he stretch.*

would—verb, irreg. (strong), trans., act., indic., past (denoting custom or repetition), sing., 3rd, agreeing with its subject 'he,' and gov. [to] 'stretch.'

(To be continued.)

PUPIL TEACHERS' LATIN COURSE.

BY L. HUXLEY, B.A.,

Classical Master Charterhouse School.

This New Latin Course (specially written for Scholarship Candidates) was begun in our issue of February 7th (No. 4., vol. XI.).

EXERCISE XX.

1. Pīnum quondam, ventō dējectām, flūviūs turbidīs āquīs dēvolvēbat. 2. Juncī crēbrī in rīpā flūvīī stabant, ventis nullō mōdō fractī. 3. Vīdēt pīnūs, et mīrātā 'O juncī,' inquit, 'quō fīt haec rēs? 4. Egō, quae tam vālidā sum, ventīs sum dējectā; vōs, spēciē pusillī, manētīs intēgrī.' 5. Respondēt ūnūs ex juncīs, 'Tū ventō rēsistīs, postrēmō cādīs; nōs stātim cēdendō pēricŭlum vītāmŭs.'

Notes for Translation.—1. *Pino-*, a pine-tree. What gender? See Ex. xviii. 2. *Vento-*, wind; *dējecto-*, part., thrown down; *flūvio-*, river; *turbido-*, swollen; *dēvolvo-*, roll down. 2. *Junco-* (m.), a rush; *rīpa-*, bank; *sta-*, stand; *nullō modō*, in no way; *fracto-*, broken. 3. *Mīrāto-* (part. deponent), wondering; *inquit*, says; *quō*, how; *fit*, is done (= pass. of *fāci-*), comes

about. 4. *Tam*, so; *valīdo-*, strong; *pūsillo-*, weak; *mānē-*, remain. 5. *Respondē-*, reply; *uno-*, one; *resist-*, stand up against, with *dat.*; *postrēmō*, adv., finally; *cād-*, fall; *stātim*, at once; *cēd-*, yield; *cadendō*, *by* yield-*ing*; *pĕrīcŭlo* (n.), danger; *vītā-*, avoid.

DECLENSION OF (pronoun) O- STEMS, with Gen. in *ius*.

	Uno-, one.			*Uter-*, which of two.		
	M.	F.	N.	M.	F.	N.
Sing. N.	ūn*ŭs*	ūn*ă*	ūn*um*	ŭtr*ŭr*	ŭtr*ă*	ŭtr*um*
Acc.	ūn*um*	ūn*am*	ūn*um*	utr*um*	utr*am*	utr*um*
G.	unī*ĭus* } for all genders			utr*īus* } all genders		
D.	ūn*ī*			utr*ī*		
Abl.	ūn*ō*	ūn*ā*	ūn*ō*	utr*ō*	utr*ā*	utr*ō*

So are declined: *alter* (g. *altĕrĭus*), *the* other, one of two; *ălĭus* (neut. *ălĭud*, gen. *alīus*), other; neuter (*neutrĭus*), neither; *uterquĕ*, each of two, both; *ullus*, any; *nullus*, no, none; *sōlus*, alone; *tōtus*, whole.

1. The plural is regular like *bonus*, o- and a- stem.

2. The gen. *ĭus* may be shortened in poetry. *Alterĭus* is short in prose.

3. For *ălīus*, *altĕrĭus* is generally used; in the possessive sense, the adj. *ălĭēnus*.

Similarly the pronouns *ille*, *is*, and *hic*.

	illĕ- (dem. pron.), that, yonder.			*is* (logical pron.), that, he.			*hic* (dem. pron.), this (at hand)		
	M.	F.	N.	Sg. M.	F.	N.	M.	F.	N.
N.	ill*ĭ*	illā	ill*ĭd*	Is	eă	Id	hīc	haec	hōc
Acc.	ill*um*	ill*am*	ill*ĭd*	eum	eam	id	hunc	hanc	hōc
G.	ill*ĭus* } for all			ējŭs } all genders			hūjŭs } all genders		
D.	illī } genders			eī			hūīc		
Abl.	illō	illā	illō	eō	eā	eō	hōc	hāc	hōc
				Pl. ii	eae	eă	hi	hae	haec
				eōs	eās	eă	hōs	hās	haec
				eōrum	earum	eōrum	hōrum	hurum	hōrum
				D. Abl. eis or iis (all genders)			his (all genders)		

As ille: *iste*, that (near you); *ipse*, self (but neut. ips*um*).

As is: *ĭdem*, *eadem*, *idem*, same (by assimilation, however, eundem, eandem, eorundem for -md-).

Hic has a termination *c* (or after a consonant *-cĕ*) which makes it more emphatic, as if one said 'this here.' So *istĭc* is formed from *istĕ*.

EXERCISE XXI.

1. Duō rustĭcī quondam in ōrā mărītimā ostream invĕniunt. 2. Alter prĭŏr vĭdĕt ostream, alter sūmit prior; ŭterquĕ sĭbī postŭlāt. 3. Ităque rixă exortă est, neutrī enim cēdĕre placĕt. 4. Mox ad-vēnit jūris pĕrītŭs; arbĭtrum eum faciunt rustĭcī. 5. At illĕ consĭlium longĕ ălĭŭd in ănĭmō hăbĕt.

Notes for Translation.—

1. Rustĭco-, country fellow (n.)
1. ōra-, shore
1. ostrea-, oyster
2. prior, first (of two)
2. postŭla-, demand, claim
3. exorto est, arose
3. placĕt, it pleases (with dat.)
4. ad-vēni-, come up
4. arbĭtro-, umpire
5. At, but
5. longe, far, very
5. ănĭmo-, mind
1. quondam (see Ex. xx.)
1. mărītima-, of the sea (adj.)
1. invēni-, find
2. sum-, pick up
3. rixa-, quarrel
3. cēd-, yield
4. Mox, soon
4. jurispērītus, lawyer
4. facĭ, make
5. consilio- (n.), design
5. aliud = different
5. habe-, have

Retranslation.—1. If (*sī*) I find oysters on the sea shore, I leave (*rēlinqu-*) none to-the-gulls (*lāro-*). 2. Nor, if I wish to distribute (*distrĭbu-*) them among (*inter*, acc.) my friends (*ămīco*), do I demand a lawyer or umpire. 3. A quarrel having arisen, my *friends*, *M.* (omit) resolved (tr. it pleased my friends) to go away; but the other party (*altĕri*, pl.) employing (*ūso* with abl.) abuse (Ex. xviii. 3) began-to-attack (impf.) them.

THIRD DECLENSION. (Consonant and i.)

Consonant Stems. Masc. and Fem.

For the Nominative Sing.

1. Stems ending in a *mute* { (p, b; c, g; t, d) or *m*, add S (before which t & d are dropped).
2. „ „ l, r, s,* or ĕn add nothing.
3. „ „ ōn or ŏn „ „ and drop the n.

All are declined alike in the oblique cases, adding—

Sing. Acc.	*em*	Pl. Nom. Acc.	*ēs*
Gen.	*is*	Gen.	*um*
Dat.	*ī*	Dat. }	*ĭbus*
Abl.	*ĕ*	Abl. }	

EXAMPLES:

	lēg-, F., law.	*pĕd-*, M., foot.	*consul-*, M., consul.
Sing. N.	le*x* (x=g+s)	pē*s*	consŭ*l*
Acc.	lēg-*em*	pĕd-*em*	consŭl-*em*
Gen.	leg-*is*	ped-*is*	consul-*is*
Dat.	leg-*ī*	ped-*ī*	consul-*ī*
Abl.	lēg-*ĕ*	ped-*ĕ*	consul-*ĕ*
Pl. N. Acc.	lēg-*ēs*	ped-*ēs*	consul-*ēs*
G.	leg-*um*	ped-*um*	consul-*um*
Dat. Abl.	leg-*ĭbus*	ped-*ĭbus*	consul-*ĭbus*

	amōr-, M., love.	*pătĕr-*, M., father.	*hŏnōs-*, M., honour.
Sing. N.	ămō*r*	pătе*r*	hŏnō*s* & honō*r*
Acc.	amōr-*em*	pātr-*em*	hŏnōr-*em*
Gen.	amor-*is*	patr-*is*	honor-*is*
Dat.	amor-*ī*	patr-*ī*	honor-*ī*
Abl.	amor-*ĕ*	patr-*ĕ*	honor-*ĕ*
Pl. N. Acc.	amor-*ēs*	patr-*ēs*	honor-*ēs*
G.	amor-*um*	patr-*um*	honor-*um*
Dat. Abl.	amor-*ĭbus*	patr-*ĭbus*	honor-*ĭbus*

	cĭnĭs, M., ashes.	*lĕgiōn*, F., legion.	*hŏmŏn*, M., man. (changes to *homĭn-*.)
Sing. N.	cĭnĭ*s*	lĕgiō*n*	hŏmo
Acc.	cĭnĕr-*em*	lĕgiōn-*em*	hŏmĭn-*em*
G.	cĭner-*is*	legion-*is*	homĭn-*is*
D.	ciner-*ī*	legion-*ī*	homin-*ī*
Abl.	ciner-*ĕ*	legion-*ĕ*	homin-*ĕ*
Pl. N. Acc.	ciner-*ēs*	legion-*ēs*	homin-*ēs*
G.	ciner-*um*	legion-*um*	homin-*um*
D. Abl.	ciner-*ĭbus*	legion-*ĭbus*	homin-*ĭbus*

VARIATIONS.

1. Like the stems in ŏn, most stems with ĕ before the final consonant change this ĕ into ĭ in the oblique cases.

Thus:	Stem.	Eng.	Nom.	Gen.
	princĕp-,	M., chief	princeps	princ*ĭp*-is
		(but *auceps*, M., bird-catcher, *aucŭp is.*)		
	jūdĕc-,	M., judge	jūdex	jud*ĭc*-is
	rēmĕg-,	M., rower	rēmex	rēm*ĭg*-is
	mīlĕt-,	M., soldier	mīlĕs	mil*ĭt*-is
	obsĕd-,	C., hostage	obsĕs	obs*ĭd*-is

Note.—This change cannot well take place when another *i* precedes the ĕ: so *ăbĭĕs*, F., fir, *ăbĭĕtis*; *drĭĕs*, M., ram, *drĭĕtis*; *pārĭĕs*, M., wall, *pārĭĕtis*; *hiem-p-s* or *hiem-s*, F., winter, *hiĕm-is*. *Interprĕs*, C., interpreter; *segĕs*, F., crop, also keep ĕ.

(To be continued.)

* This *s* changes into *r* before a vowel (except in *vās*, N., vessel; *os* [*oss-*], *N.*, bones; and *mens-is*, M., month). The *r* is often adopted in the nom. also. See declension of *honos-*.

THE METRIC SYSTEM, AND HOW TO TEACH IT.

BY CHAS. BOWDEN.

In working sums in compound addition, subtraction, multiplication, and division of money, the children of the Standards which have been taught decimal fractions will find no difficulty. The rule is simply to write down the amounts in terms of the unit, and proceed as in ordinary decimal fractions. So far as relates to addition and subtraction, this rule could be followed by Standard V., but in order to avoid the difficulties of *pointing* in multiplication and division, another simpler rule, applicable to all the Standards, may be given.

Compound Addition and Subtraction.

Rule.—Write down each of the quantities to be added or subtracted in the lowest denomination mentioned in any of them. Then add or subtract the numbers as in simple addition or subtraction. The sum or difference will be the answer in this denomination. If necessary, mark off in the answer the different denominations.

Worked Examples in French Metric System.

1. Add together 342 fr. 5 d. 6 c., 72 fr. 55 c., 2 fr. 6 d. 7 c., 364 c., 54 d. 4 c., 6 fr. 5 d. 9 c., 290 d., 65 fr.

Here the lowest denomination is centimes. Write down each item in centimes, thus:—

342 fr. 5 d. 6 c. = 34256 centimes.
72 fr. 55 c. = 7255 „
2 fr. 6 d. 7 c. = 267 „
364 c. = 364 „
54 d. 4 c. = 544 „
6 fr. 5 d. 9 c. = 659 „
290 d. = 2900 „
65 fr. = 6500 „

Sum = 52745 „
= 527 fr. 4 d. 5 c. or 527 fr. 45 c. Ans.

2. From 725 fr. 3 d. 5 c. take 26 fr. 44 c.

725 fr. 3 d. 5 c. = 72535 centimes.
26 fr. 44 c. = 2644 „

Difference = 69891 „
698 fr. 9 d. 1 c. or 698 fr. 91 c. Ans.

Worked Examples in United States Currency.

3. Add $426 53 c., $7 27 c., $1000, $5274 16 c., $5 5 c., $732½.

($ = 1 dollar; 100 c. = 1 dol.; ½ dol. = 50 c.)

$426 53 c. = 42653 cents.
$7 27 c. = 727 „
$1000 = 100000 „
$5274 16 c. = 527416 „
$5 5 c. = 505 „
$732½ = 73250 „

Sum = 744551 „
= $7445 51 c. Ans.

4. If I had $100 15 c. in my purse and paid away $6 9 c., how much should I have left?

$100 15 c. = 10015 cents.
$6 9 c. = 609 „

Difference = 9406 „
= $94 6 c. Ans.

Worked Examples in proposed English Currency.

5. Find the sum of £64 9 fl. 3 c. 1 m., £721 72 m., £419 264 m., £6·914, £71 6 fl., 19 fl. 3 c. 4 m., 1,496 c., 127 fl.

Here the lowest denomination is *mills*. Express each item as mills, thus:—

£64 9 fl. 3 c. 1 m. = 64931 mills.
£721 72 m. = 721072 „
£419 264 m. = 419264 „
£6·914 = 6914 „
£71 6 fl. = 71600 „
19 fl. 3 c. 4 m. = 1934 „
1496 c. = 14960 „
127 fl. = 12700 „

Sum = 1313375 „
= £1313·375 „ or
= £1313 3 fl. 7 c. 5 m. Ans.

6. Find the difference between £64 17 c. and £6 9 fl. 3 c. 9 m.

(Express each item in mills.)

£64 17 c. = 64170 mills.
£6 9 fl. 3 c. 9 m. = 6939 „

Diff. = 57231 „
= £57 231 m. or
£57 2 fl. 3 c. 1 m. Ans.

Examples for Practice.

1. Add together 723 c., 1296 c., 14945 c., 3000 c., 72 c., 109657 c. Give answer (a) in francs and centimes. (b) in francs, decimes, and centimes.

2. What will 54 fr. 56 c., 594 fr. 17 c., 4 fr. 11 c., 729 fr. 16 c., 295 fr. 49 c. amount to. Give the answer (a) in francs and centimes (b) in francs, decimes, and centimes (c) in decimes and centimes.

3. A grocer charged $5 64 c. for flour, $17 50 c. for sugar, $15 75 c. for tea, and $6 36 c. for coffee. What did the whole bill amount to?

4. A farmer sold wheat for $7000 65 cents, barley for $950 15 c., oats for $636 12 c., and maize for $3275 85 c. (a) How many dollars and cents (b) how many cents did he receive?

5. The following were the items in a draper's bill:—Silk £9 3 fl. 7 c. 2 mills, satin £64½, velvet £72·95, woollen £64 723 m. What was the total (a) in £'s (b) in florins (c) in cents (d) in mills (e) in £, fl., c., m.

6. Add £43·756, £92·84, £2000½, £185 6 f. 3 c. 2 m., 426 m. 75 c. £9·4

7. Which is the greater and by how much, 329·75 fr. and 1000·5 francs.

8. From £100·56 take £72 3 fl. 5 c.

9. How many mills difference is there between £16 5 c. and 120 fl. 4 mills?

10. Subtract £42 325 mills from £326 5 f. 6 mills.

11. A lady paid $58·13 for a mantle, and $100 20 c. for a dress. What was the cost of the two, and by how much did the cost of the dress exceed that of the mantle?

12. What shall I have left out of 100 fr. after paying away 50 two-cent pieces, 10 five-cent pieces, 60 ten-cent pieces, 16 half-francs, 10 francs, and 14 two-franc pieces?

(To be continued.)

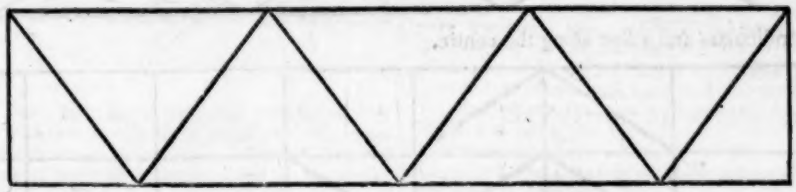
Teachers' Notes of Drawing Lessons for Standard III.*

By an Art Teacher under the London School Board.

Running patterns with diagonal lines.

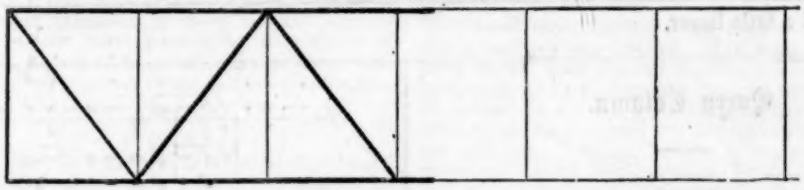
OBLONG.

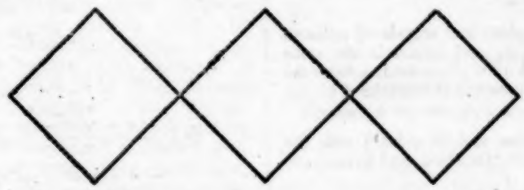
5. Copy.



Draw perpendiculars with set-squares as in preceding examples.

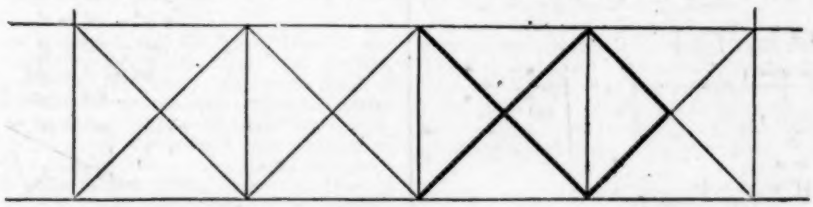
5. Work.





6. Copy.

Use horizontals and perpendiculars as before, and NOT the 45° angle.



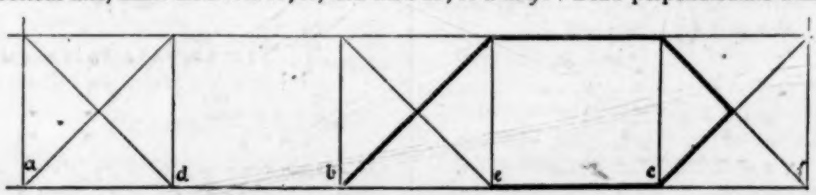
6. Work.

Repeat in freehand—larger.

RUNNING PATTERNS.

7. Copy.

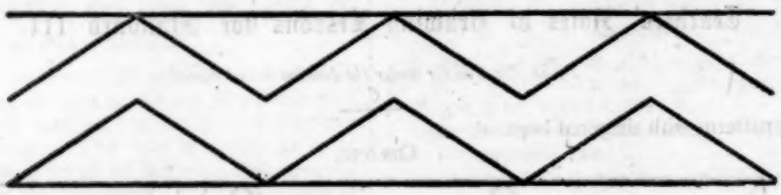
Along the bottom line, mark distances *ab*, *bc*, and then *ad*, *be* and *cf*. Draw perpendiculars with set-square.



7. Work.

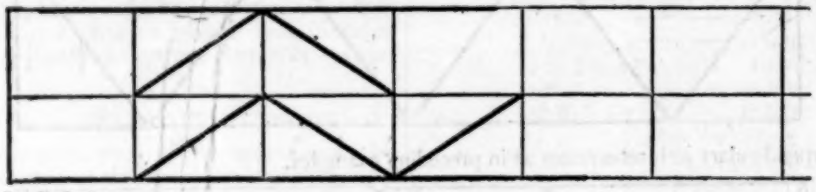
* The Teaching of Drawing becomes compulsory on September 1st, 1891. These articles will be specially helpful to teachers who know but little of the subject. They will teach them how to teach it successfully.

8. Copy.



Use perpendiculars and a line along the centre.

8. Work.



Freehand a little larger.

Query Column.

Algebra.

1. J. T. L.—A sets out from a place and travels 2½ miles an hour. B sets out 3 hours after A, and travels in the same direction, 3 miles the first hour, 3½ miles the second, 4 miles the third, and so on. In how many hours will B overtake A?

(*Todhunter's Algebra for beginners.*)

B has to gain ($2\frac{1}{2} \times 3$) or $7\frac{1}{2}$ miles, and he gains ½ mile the first hour, 1 mile the second, 1½ miles the third, and so on.

$$S = [2a + (n-1)d] \times \frac{n}{2};$$

$$\therefore 7\tfrac{1}{2} = [(\tfrac{1}{2} \times 2) + \{(n-1) \times \tfrac{1}{2}\}] \times \frac{n}{2}$$

$$= \left(1 + \frac{n-1}{2}\right) \times \frac{n}{2}$$

$$15 = \frac{2 + n - 1}{2} \times n$$

$$= \frac{n(n+1)}{2}$$

$$30 = n^2 + n$$

$$n^2 + n + (\tfrac{1}{2})^2 = 30 + \tfrac{1}{4}$$

$$= \tfrac{121}{4}$$

$$n + \tfrac{1}{2} = \tfrac{11}{2}$$

$$\therefore n = \tfrac{11}{2} - \tfrac{1}{2}$$

$$= 5$$

$\therefore$ Time = 5 hours. Ans.

2. LETA.—Find the relation between a and b in the equation

$$x^2 + ax + b = 0.$$

(i.) When the roots are equal,
(ii.) When one is twice the other.

$$x^2 + ax + b = 0$$

$$x^2 + ax = -b$$

$$x^2 + ax + \left(\frac{a}{2}\right)^2 = \frac{a^2}{4} - b$$

$$= \frac{a^2 - 4b}{4}$$

$$x + \frac{a}{2} = \pm \frac{\sqrt{a^2 - 4b}}{2}$$

$$\therefore x = \frac{-a + \sqrt{a^2 - 4b}}{2} \text{ and } \frac{-a - \sqrt{a^2 - 4b}}{2}.$$

(i.) $$\frac{-a + \sqrt{a^2 - 4b}}{2} = \frac{-a - \sqrt{a^2 - 4b}}{2}$$

$$\sqrt{a^2 - 4b} = -\sqrt{a^2 - 4b}$$

$$a^2 - 4b = -(a^2 - 4b)$$

$$= -a^2 + 4b$$

$$2a^2 = 8b$$

$$a^2 = 4b$$

$$\therefore a = 2\sqrt{b}.$$

(ii.) $$\frac{-a + \sqrt{a^2 - 4b}}{2} = \frac{-a - \sqrt{a^2 - 4b}}{2} \times 2$$

$$-a + \sqrt{a^2 - 4b} = -2a - 2\sqrt{a^2 - 4b}$$

$$\sqrt{a^2 - 4b} + 2\sqrt{a^2 - 4b} = a - 2a$$

$$3\sqrt{a^2 - 4b} = -a$$

$$9(a^2 - 4b) = a^2$$

$$9a^2 - 36b = a^2$$

$$9a^2 - a^2 = 36b$$

$$8a^2 = 36b$$

$$2a^2 = 9b$$

$$\therefore a = 3\sqrt{\frac{b}{2}}.$$

Arithmetic.

1. YOUNGS.—A contractor engages to complete a tunnel 3·75 miles long in two years and ten months, and employs 1,200 men on the work; at the end of a year and a-half only ·375 of the work is completed. How many additional men must he employ to complete the work in the stipulated time?

Time remaining = 2 years 10 months − 1½ years.

= 1 year 4 months.

Part of the work remaining = 1 − ·375

= ⅝;

$$\left.\begin{matrix}\text{Yrs.} & \text{Yrs.} \\ 1\frac{1}{2} & 1\frac{1}{4} \\ \frac{3}{2} & \frac{5}{4}\end{matrix}\right\} :: \begin{matrix}\text{Men.} \\ 1{,}200\end{matrix} : \text{Number of men altogether.}$$

$$= \frac{3}{2} \times \frac{5}{8} \times \frac{150}{1200} \text{ men}$$

= 2,250 men;

$\therefore$ Number of additional men = 2,250 − 1,200

= 1,050. Ans.

THIS suggests two considerations. We cannot control the weather, nor can we help it when a ship, already at sea, is caught in a gale. But it does seem to call for a word of protest that the authorities persist in sending a vessel to sea, even though she has mails to carry, in the teeth of such a storm as that of Monday night. The facts show that the Victoria was within an ace of going ashore, as her namesake of Newhaven went ashore a few years ago; and then what would have happened to the passengers who were so eager to get across, and to the precious mails?

***

THE line has been laid for a practical purpose, but it cannot fail to to have a political importance. The wire stretching from shore to shore is a material link of friendship between the two countries, and it can foster that friendship quite as well as a commercial treaty or a formal alliance. Slowly but surely the old isolation is being overcome; traditional prejudice, the offspring of past enmities and ignorance, is dying out, and men of different nations are learning to think more kindly of each other. It is just forty years since England and France were joined together by the first telegraph cable.

***

NEXT morning the dirty white cliffs of the headlands and the bleak hollows of the Downs were patched with drifted snow, and the scene was wintry in the extreme. A tawny sea, lashed into foam by a strong easterly gale, with squalls of mist and rain prevented, further operations. Wednesday was not much better, for, although it brightened up, the glass was still unsettled. The Monarch was now lying at Dover, where she went to land a visitor and take in stores. Thursday was fine, and after picking up the cable from the buoy she proceeded to clear it from the lost anchor. The line was coiled four times round the anchor, and could only be released by cutting out the damaged part.

***

IN the south-east and south-west districts of London employment in abundance for slaters, carpenters, glaziers, and gardeners, and even bricklayers, will be one result of the storm. Roofs have been partially stripped of slates and tiles, the framework and glass of conservatories injured beyond repair, and flower-beds and shrubberies destroyed, even gate-pillars being dismantled and small boundary brick walls thrown down. Some fine trees in Dulwich have been uprooted, and in Brixton the windows in some private houses have been blown in. The river Thames was yesterday much swollen owing to the amount of snow it carried down from the upper reaches.

***

HIS Imperial Majesty was extremely displeased to see the way in which the perfectly innocent picture of his son and heir, resting after a panther hunt, had been treated by these gentlemen, and at once gave orders for the matter to be looked into. The consequence was that the second impression of the photograph was allowed to go into circulation without the hideous mark of official disapproval which figures on the same page and represents the first impression of the picture. But a few lines of the attempt to explain the reason of it having been so defaced nevertheless is blacked over at the foot of the page.

***

THE 'coming of age' of every Siamese child in any family pretending to fashion is celebrated with a quaint and picturesque custom—the cutting of the top-knot. This top-knot is nothing more than a round patch of hair allowed to grow on the crown of the head, while the rest of the hair is closely shaved. The jet-black locks, still fine and glossy, are wound round into a coil, fastened by a large pin with a gold and sometimes jewelled head, and surrounded on festive occasions by a tiny chaplet of sweet-scented white flowers.

***

BUT a Siamese procession is in itself a marvel, compared with which the most ambitious Lord Mayor's Show is a very one-horse affair. The Royal crown alone, worn by the King in his palanquin, would, if converted into pounds sterling, pay for a great many such shows. So would his jewelled uniform, and so would the crown of the small Prince. Many thousands of pounds' worth of pure gold is carried along on the belts and Court uniforms of the grandees; and an inventory of the other 'properties' displayed would rather astonish a manager of stage processions in Europe.

***

THE small boat dropped down close to the funnel, and the excitement was intense. The man climbed down close to the boat, but could not reach it. The sea was boiling up all round him, and the boat was shipping a lot of water. At last he got a foot over the gunwale of the boat, let go, and dropped in. He had still a good deal of strength left. I expect he was a seaman, and as the steamboat towed his boat ahead he did his best to clear her of the rigging, &c., which hung down around him. But in vain; her bow caught and would not free; the towing boat was helpless to pull him clear. The seas soon swamped his boat, and, after a prolonged struggle, he was washed away. A more terrible sight, this fight for life, it is impossible to imagine.

***

THIS was done, the anchor and chain being recovered, and the end of the cable buoyed. She returned to Dover. On Friday nothing could be done owing to the high wind and sea; but Saturday morning was as quiet as a lamb, the blue sky smiling through fleecy clouds. The Monarch was early astir, and although the sea was a little hazy, and a strong easterly breeze blowing, the glass was very steady. The ship had spliced the cable by 20 minutes past 11, and then picked up some five miles of cable from the buoy, towards Sangatte, relaying it so as to clear a bight in the Calais-Dover line, arriving off St. Margaret's about 20 minutes past three in the afternoon.

Publications Received.

DAWSON, A. G.—Second Grade Freehand Tests (*W. Bridge*). Twenty-six Dictation Tests (*T. P. Cowling*).

HEYWOOD, JOHN.—Armenia, The Armenians, and the Treaties. (*M. G. Rolin-Taequemyns*).

HODGES, FIGGIS & Co.—On 'The Use of Greek' (*M. C. Hime*).

LEDSHAM, JAS. B.—Ledsham's Manley Arithmetics; Stds. II. to VII. (*A. Jordan*).

LONGMANS AND CO.—A Student's History of England: Vol. II. (1509—1689) (*Gardiner*).

NELSON AND SONS.—The Royal Standard Authors, 4; The School Hand-Atlas (*Bartholomew*).

SUTTON, DROWLEY AND CO.—Conjugations of Irregular and Defective French Verbs (*Brewer*).

SMITH, ELDER AND CO.—The Cornhill Magazine for April.

FOR SCHOLARS AND TEACHERS.

Price 1d. Price 1d.

THE METRIC SYSTEM MADE EASY.

With numerous WORKED OUT Examples. By JOSEPH WOLLMAN.

SUITABLE FOR UPPER STANDARDS, AND FOR TEACHERS' USE.

Adopted by Leading School Boards.

DR. BEACH'S ENTERTAINING READERS

Recommended by H.M.I.

A B C Book	Price 1d.	INFANTS' READER	Price 4d.	STANDARD II.	Price 9d.
PRIMER ..	„ 2d.	STANDARD I. ..	„ 8d.	STANDARD III.	„ 1s.

STANDARD IV. .. .. Price 1s. 3d.

WHAT TEACHERS SAY.

Mr. E. New, Head Master Southwick Board School, Sussex:—'I consider them to be the BEST I have seen during an experience of 44 years.'

Mr. P. Poynter, Head Master Board School, Ruarden:—'If I, a Head Master since 1858, may be allowed to judge, I should say Dr. Beach's Books for lower standards **are the best in the market.**'

The Head Master Wesleyan School, Ealing, London:—'Dr. Beach's Readers are the finest little books (Infants) of their kind I have ever seen.

Mrs. Rogers, Head Mistress Granby Road Board School, Manchester:—'Charmed with them,' (Infants' books).

Mr. Thos. C. Elliot, Head Master Springfield Boys' Board School, Sheffield:—'Dr. Beach's New Readers will, I am sure, be popular; they are both *original* and "Entertaining." We had demonstrative proof of the latter at home. I placed them in the hands of my children, and we had to use rather urgent language at "meal-time" to get them to lay them aside to have their food.'

Mr. Herbert Wills, Head Master Halliwell Road School, Bolton:—'I am charmed with your New Infant Readers.'

Mrs. Curphey, Head Mistress Beech Lane Schools, Macclesfield:—'Will make the Reading lessons longed-for by the children. I am having them throughout the school for the coming year.'

Mr. J. T. Titchener, Head Master Wesleyan School, Whitchurch:—'Certain to be great favourites with the scholars. They are very original and full of interest.'

Mr. G. H. Pitt, Head Master Ardsley Board School, Barnsley:—'I have seen Standard I. and am delighted with it; it is quite out of the ordinary run of Reading Books. If the others are equal to it, I shall never rest until I have a full set throughout the school.'

Mr. J. Porter, Head Master Manse Lacy School, Hereford:—'The books are novel, and are quite a new departure from the ordinary School Reader, and although full of fun and amusement, I find a vein of good instruction underlying all the stories, so that the books will not only amuse, but will help materially to sharpen the wits of the scholar. These books will be gratefully welcomed by all teachers into whose hands they may fall.'

Mr. F. Baxter, B.A., Head Master Boys' Board School, Bideford:—'My boys are enraptured by Dr. Beach's Entertaining Reader No. 2.'

Mr. Thos. W. Berry, Head Master Christ Church Schools, Stone, Staffs.:—'I like Dr. Beach's Readers very much indeed, and so do the children; this is a conclusive proof that they are "entertaining."'

Mr. T. Morgan, Priory Street Boys' National School, Carmarthen:—'Having heard so much about the excellency of Dr. Beach's Entertaining Readers, I shall be very pleased to receive specimens of Standards I. and III.

The Head Mistress of a Large Infants' School (average upwards of 800):—'Will you kindly send me specimens of Dr. Beach's Entertaining Readers, which have been recommended to me by H.M.I.?'

Mr. T. Archey, Head Master Certified Industrial Boys' School, York:—'A few days ago I was speaking to one of H.M.I.'s respecting Reading Books. He spoke very highly of Dr. Beach's Entertaining Readers.'

LONDON: JOSEPH HUGHES & Co., PILGRIM STREET, LUDGATE HILL, E.C.

PRINTED BY W. P. GRIFFITH & SONS (LIMITED), and PUBLISHED BY JOSEPH HUGHES & CO. FOR THE EDUCATIONAL MAGAZINE PUBLISHING COMPANY (LIMITED), AT 5, PILGRIM STREET, LUDGATE HILL, LONDON, E.C.